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# Preliminary Investigation of the Status of Domestic and Commercial Sewage Management in Benin Metropolis, Nigeria

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# Preliminary Investigation of the Status of Domestic and Commercial Sewage Management in Benin Metropolis, Nigeria

**Abstract**

Among the multitude of problems in Benin metropolis waste appears to be the most prominent in recent years. However, efforts on waste management in Benin metropolis is directed mainly towards solid waste stream as it seems to be more problematic. This study was therefore carried to as a preliminary investigate of the status of sewage and sewage management in Benin metropolis. The study was broken down into two phases – A study of current sewage management system in Benin metropolis and a survey of the chemical composition of household (Residential, commercial and institutional) sewage in Benin metropolis. The results obtained shows that sewage is discharged into soak-away pit without treatment. The range of potassium found in the samples of sewage analysed in the laboratory was 5.89 mg/l to 152.91mg/l and the range of phosphorus was 0.08 mg/l to 9.96 mg/l. In addition the range of lead and mercury were 0.01 mg/l to 0.16 mg/l and 0.04mg/l to 0.52 mg/l. Considering these results from the study there is need for serious attention to be given to sewage management in Benin metropolis.

**KEYWORDS:** Waste, Sewage, Sewage Management, Benin Metropolis, Nigeria.

## 1.0 INTRODUCTION

In the last few decades waste has been on the increase due to the increase in population and the expansion of human activities. Generally, wastes include three streams – solid, liquid and gaseous waste. However, efforts on waste management in Benin metropolis appears to be directed mainly towards solid waste stream as it seems to be more problematic in the metropolis in recent years. Liquid waste stream is otherwise referred as sewage. Sewage is defined as water carried waste in either solution or suspension that is intended to flow away from a house or community (Duncan, 2004). Sewage is generated from domestic, commercial and industrial activities. Oluwande (1978) and Garg (2009) defined domestic sewage as liquid waste from kitchen sink, from the bathroom, lavatory, laundry, toilet washbasin and the entire total run-off from residential, commercial and institutional buildings.

Therefore "Sewage" means and includes human excreta, black water, water-carried wastes, and liquid household waste from residences or commercial and industrial establishments. (Georgia Department of Public Health Environmental Health Section, 2016). Sewage is generally extremely foul, because of the presence of human excreta in it (Garg, 2009).

In most large towns and cities in Nigeria, large volumes of liquid wastes (sewage) is discharged into the environment without treatment. (Aina, 1991; Omuta, 1999; Obasi and Balogun, 2000). Leacheates from this wastes find its way into boreholes, lakes, wells and other water bodies (Mogborukor, 2012). "Sewage Treatment System" is a system that provides primary treatment and disposal, including absorption field components, devices, and appurtenance intended to be used for disposal of sewage by soil absorption (Georgia Department of Public Health, Environmental Health Section, 2016).

In Benin metropolis like other large towns and cities in Nigeria, sewage is simply discharged into holes in the ground or channeled into the runoff water or into the gutter.

Hence, during building design and construction in the metropolis provision is made for septic tanks and soak away pits. Leacheates from this wastes find its way into ground water which is currently the main source of drinking water in the metropolis.

This study was therefore carried out as a preliminary investigation of the state of sewage and sewage management in Benin metropolis, using households in University of Benin and environs as a case study. The staff quarter and communities around the university of Benin have staff and students of the University and other members of the society as occupants. The communities are well homogenized and have good representation of the middle and lower social classes. Therefore, they are good representations of the of Benin metropolis.

### 1.1 Background Information of Study Site

Benin City was the capital of the ancient Benin kingdom but as a result of the influx of people from the rural area and neighbouring states the City experienced tremendous expansion and developed into a metropolis. Benin metropolis is currently the head quarter of Edo State of Nigeria. There are three (3) geographical zones in Benin metropolis - traditional core, transitional zone and, outer zone (Ikelegbe and Ogeah, 2003). The traditional core is the area in bounded by the City moat and consists of a large percentage of old mud houses. The monarch of Benin kingdom has his palace in the traditional core zone of the metropolis. The traditional core has a high percentage of the lower social class of the population in the metropolis. The transitional zone is the area that has been added to the traditional core due to development in Benin metropolis. This area has the largest proportion of the middle social class, followed by the lower social class and upper social class. The outer zone is the periphery of Benin metropolis which consists of the sub-urban development at the fringe of the City. The study site - households in University of Benin and the neighbouring communities falls within the transitional zone of the metropolis, hence it was suitable for this study.

## 2.0 METHODOLOGY

This study was broken down into two phases – A study of current sewage management system and sewage management activities in Benin metropolis and a preliminary survey on the chemical composition of household (Residential, commercial and institutional) sewage in Benin metropolis. The first phase of the study involves the study of published and unpublished government agencies reports/records, private Agency report, personal communication with private and government waste management agencies, literature review and a preliminary field work in Benin metropolis. The survey involved the following steps – determination of a representative sample, selection of sampling units and the use of structured questionnaires to collect primary information such as size of households, income, Educational level etc. from the selected sampling units.

A multi-stage stratified sampling method (Drew, 1980) was applied for the sampling process and a total of 250 sampling units (EPA, 1996), made up of 200 households and 50 commercial and institutional units were selected for the survey. 156 households made up of 660 persons and 42 commercial units co-operated with the survey. The sampling area was stratified into homogeneous groups. 10% of the sampling units were systematically selected for collection of samples of sewage for laboratory analysis. Each selected sampling unit was visited several times. In the first visit, contact was made and participation consent requested. Upon approval, a second visit was made to distribute questionnaires and discuss collection of samples of their sewage. The next visits were made to retrieve questionnaires and collect samples of sewage. The sewage samples were collected with two litres plastic container from the selected sampling units. Plastic container which cannot easily react with the sample were used so that the result will not be affected by the containing vessel. Samples of borehole water were also collected and

subjected to similar analysis to determine the composition of the water and make comparison with results from sewage analysis to find out if indiscriminate disposal of untreated sewage has effect on ground water deposit. As mentioned earlier 10% of the sample size were systematically selected for laboratory analysis. Hence a total of twenty five (25) samples were analysed in the laboratory.

### 2.1 Analysis of Samples in the Laboratory

All the samples collected were analysed in the department of chemistry, in Nigeria Institute for Oil Palm Research (NIFOR), Benin City. Two methods - The atomic absorption method and Photometric method were used in this analysis. Atomic absorption method was used to test for lead, phosphorus and potassium while photometric method was used to test for mercury.

The sewage samples were shaken to obtain homogeneous solution, one litre portion was accurately transferred into 2 litre beaker. 10 ml concentrated Nitric acid was added and digested on the hotplate until the solution becomes clear. The clear solution was filtered into one litre standard flask, made to mark with distilled water and the filtrate subjected to analysis of potassium, phosphorus, lead and mercury. The potassium content was estimated by flame photometer, phosphorus by Ammonium molybdenum blue method while mercury by decolourization of Ferric Nitrate none-hydrate in the present of Nitric acid.

## 3.0 RESULT AND DISCUSSION

The result from this preliminary study in Benin metropolis revealed that domestic sewage and commercial sewage are discharged to environment without treatment. The method of disposal is very simple. Soak-away pit of about four to six meters deep were constructed by excavating the soil and the Sewage was channeled form sources into the

soak-away pit and allowed to seep into the ground. Observation of the location of the soak-away pits revealed that some the soak-away pits were located close to private water boreholes which are the sources of drinking water for the households and commercial units. In addition the borehole water were not purified before consumption.

The results obtained from the laboratory analysis of sewage samples and samples of drinking water collected from boreholes in Benin metropolis was shown in table 4.1. The range of potassium found in the samples of sewage was 5.89 mg/l to 152.91mg/l resulting in an average of 52.71mg/l. while that of borehole water sample was 1.08mg/l to 2.25mg/l giving an average value of 31.97mg/l. The results also revealed that the range of phosphorus found in sewage samples was 0.08mg/l to 9.96mg/l, resulting in an average of 2.70mg/l. While the range of phosphorus found in the borehole water was 0.02mg/l to 0.14mg/l. With an average of 0.32mg/l

However, no lead or mercury was found in the borehole water, but the value of lead found in the sewage has a minimum value of 0.01mg/l and maximum value of 0.16mg/l. while mercury has a minimum value of 0.04mg/l and maximum value of 0.52mg/l.

If such amount of potassium found in the sample of sewage is continuously discharged into the environment through soak-away pits over a period of time, it will continue to affect the ground water deposit up till a point where it will exceed the recommended amount of potassium needed for the human body. These will result in the effect of potassium toxicity (whittney and Rofles, 2005). In addition If such amount of phosphorus, lead and mercury found in the samples of sewage are continuously discharged into the environment without treatment over a period of time, it will also continue to affect the ground water deposit up till a point where they will exceed the recommended amount of

phosphorus allowable in drinking water. However, no amount of lead is allowed in drinking water because of it's adverse effect on the body (whittney and Rofles,2005).

The presence of chemicals like phosphorus and potassium in the water samples collected from the water boreholes may be due to leaching from the sewage. Considering these results from the study there is need for serious attention to be given to sewage management in Benin metropolis.

## 4.0 CONCLUSION AND RECOMMENDATION

The range of potassium found in the samples of sewage was 5.89 mg/l to 152.91mg/l resulting in an average of 52.71mg/l. while that of borehole water sample was 1.08mg/l to 2.25 mg/l giving an average value of 31.97 mg/l. The results also revealed that the range of phosphorus found in sewage samples was 0.08 mg/l to 9.96 mg/l, resulting in an average of 2.70mg/l. While the range of phosphorus found in the borehole water was 0.02 mg/l to 0.14 mg/l. With an average of 0.32 mg/l

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Currently the source of drinking water is mainly private boreholes with untreated water. There is therefore need for the government to give adequate attention to regulate the production of borehole to ensure that the level of contaminants in the drink water is within acceptable standard. Considering these results from this study there is need for attention to be given to sewage management in Benin metropolis. There is also need for more extensive study to be carried out on sewage and drinking water in the metropolis.

**Table 4.1 Result of samples analyzed in the laboratory.**

| Sample number | Source of sample | Potassium (K) mg / l | Phosphorus (P) mg/l | Lead (Pb) mg/l | Mercury (Hg) mg/l |
|---|---|---|---|---|---|
| 1 | HH 1 | 45.17 | 1.04 | 0.02 | 0.12 |
| 2 | HH 2 | 65.60 | 9.96 | 0.05 | 0.06 |
| 3 | HH 3 | 100.46 | 7.22 | 0.11 | 0.13 |
| 4 | HH 4 | 11.04 | 0.66 | 0.01 | 0.28 |
| 5 | HH 5 | 9.48 | 0.08 | 0.01 | 0.29 |
| 6 | HH 6 | 85.93 | 5.56 | 0.04 | 0.22 |
| 7 | HH 7 | 21.34 | 7.10 | 0.09 | 0.52 |
| 8 | HH 8 | 5.89 | 0.19 | 0.01 | 0.38 |
| 9 | HH 9 | 144.26 | 4.86 | 0.06 | 0.26 |
| 10 | HH 10 | 9.94 | 0.37 | 0.02 | 0.10 |
| 11 | HH 11 | 12.42 | 0.14 | 0.01 | 0.35 |
| 12 | HH 12 | 57.04 | 7.51 | 0.04 | 0.14 |
| 13 | HH 13 | 37.98 | 0.16 | 0.02 | 0.04 |
| 14 | HH 14 | 27.09 | 0.63 | 0.03 | 0.19 |
| 15 | CS 1 | 41.94 | 1.63 | 0.02 | 0.21 |
| 16 | CS 2 | 34.56 | 0.19 | 0.02 | 0.35 |
| 17 | CS 3 | 35.46 | 0.17 | 0.02 | 0.25 |
| 18 | CS 4 | 33.30 | 0.11 | 0.01 | 0.07 |
| 19 | CS 5 | 42.48 | 0.10 | 0.02 | 0.12 |
| 20 | CS 6 | 132.57 | 7.71 | 0.11 | 0.09 |
| 21 | CS 7 | 152.91 | 1.33 | 0.16 | 0.06 |
| 22 | BW 1 | 1.98 | 0.06 | 0.00 | 0.00 |
| 23 | BW 2 | 1.62 | 0.05 | 0.00 | 0.00 |
| 24 | BW 3 | 2.25 | 0.02 | 0.00 | 0.00 |
| 25 | BW 4 | 1.08 | 0.14 | 0.00 | 0.00 |

HH - Household. CS - Commercial Source. BW - Borehole Water

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